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PRESENT AND ICE AGE LIFE ZONES AND DISTRIBUTIONS

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In describing the distributional ranges of any insect, it is very desirable that some means of rapid correlation with a climatic zone (or vegetational zone) be available. Many years ago, Merriam (1898) found a scheme of "life-zones" useful for the purpose of describing the distribution of North American mammals; such zones were heavily relied on by other vertebrate zoologists as an aid toward the ecological description of distribution patterns (see Grinnell and Storer, 1924 and Hall and Grinnell, 1919).

In addition to existing life zones, some idea of the distribution of the zones in the immediate geological past is desirable. L. S. Dillon (1956) has attempted to show the relationship between the life zones of the present and of the ice age. The reader should refer to his paper for an excellent discussion of the subject. Nevertheless, since that paper is not radily available to many readers of this Journal, two significant maps from that paper are here redrawn and reproduced in color. The first is a simplified map of Merriam's Life Zones of the present and the second is a map showing the presumed or hypothetical location of the same life zones during the Wisconsin ice age.

Of prime importance to formulation of conclusions on the possible reasons for some idiosyncrasies in present day distributions, one major fact emerges. Continuity of distribution between Alaska and the more southerly parts of North America which existed before and now exist after the ice ages were completely broken for a long period of time. For example, if one took a group of Colias such as Vaccinium feeders which are nearly circumpolar, it is apparent that these could extend without much discontinuity from Europe across Asia into Alaska and across northern North America. The ice barrier of the Pleistocene, however, effectively isolate the Alaska end of the Asian distribution from the more southerly parts of the North American distribution and the possibility of local races or species developing

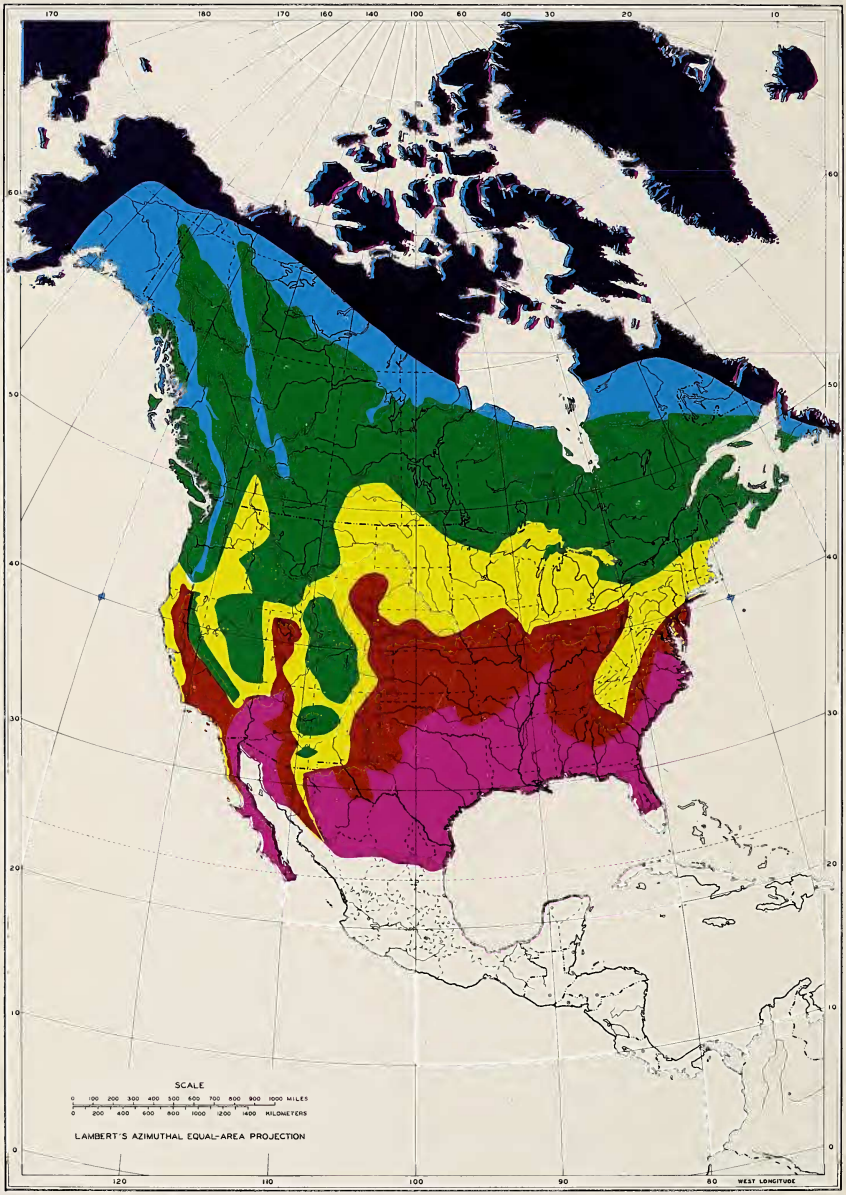

FIG. 1 Present day life zones (simplified from Merriam and Dillon). Purple: Arctic-alpine (tundra); blue: Hudsonian; green: Canadian; yellow: Transition; red-orange: Upper Austral (Sonoran); red-magenta: Lower Austral (Sonoran). Ice not shown in Greenland and adjacent islands.

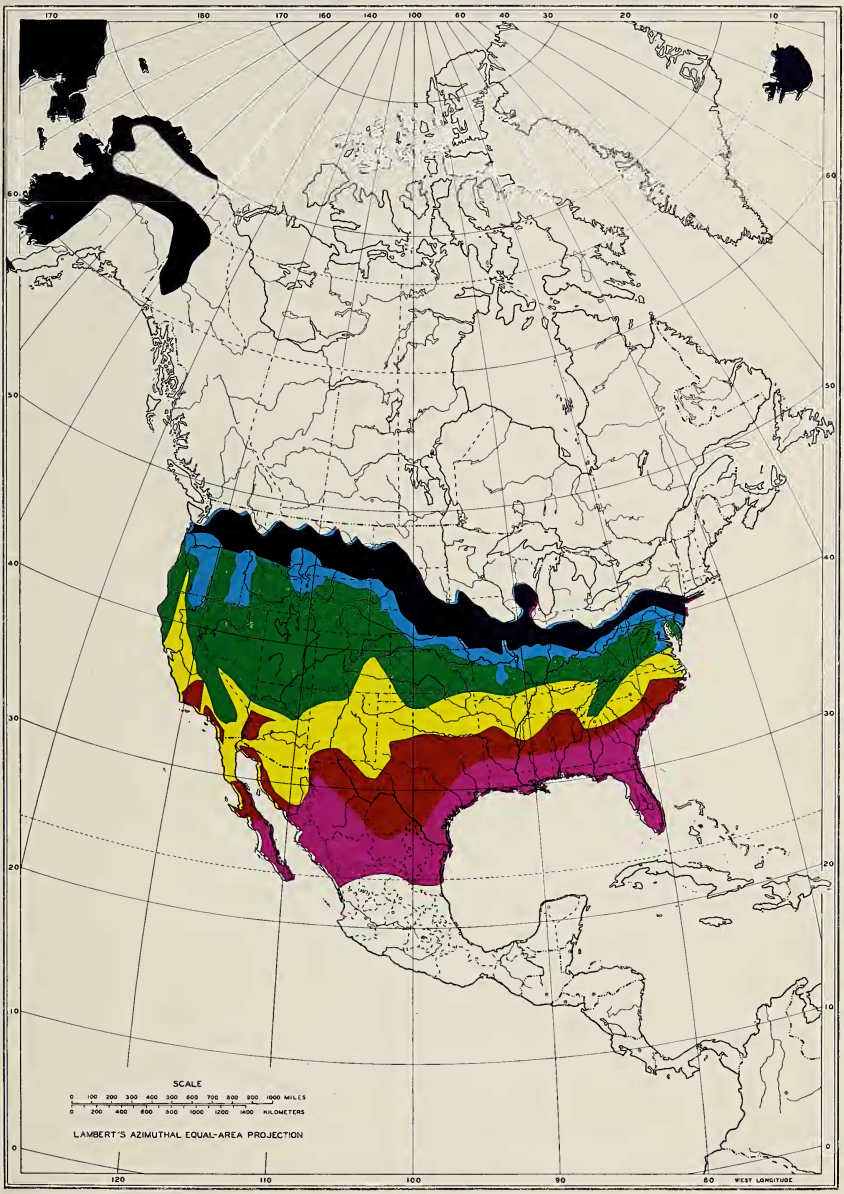

FIG. 2. Hypothetical life zones of the Wisconsin ice age. Same legend as Fig. 1 except white in north designates arctic glaciation. Both these figures have been redrawn from Figures 10 and 11 of Dillon (1956) and reproduced in color by permission of Lawrence S. Dillon and *Science*, published by the American Association for the Advancement of Science, Washington, D.C.

would be strong. *Colias paleano* (The Eur-Asian Vaccinium feeder) would remain in that sector but new forms would develop through genetic isolation and habitat selection southeast of the ice. For example, *Colias interior* might have developed spanning the North American continent, or *Colias minisni* in the southern Canadian Rockies, or *Colias behri* in the Sierra Nevada, or *Colias pedidne* in Labrador and possibly *Colias scudderi* in the southern Canadian Rockies. Movement northward of *Colias interior* and southward of *Colias palaeno* after the retreat of the ice would create a zone of hybridization if they retained the same ecological niches, and were still interfertile. But such was not the case and from the mouth of the MacKenzie River to Manitoba, they overlap with no known mixing. Two other species (*Colias hecla* and *C. nastes*) however have been confused by the new habitats following retreat of the glaciers and have partly blended together with the formation of a partial new species (*Colias boothi*) (Hovanitz 1950, 1951 and 1963).

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